

FORM PTO-1390
(REV 12-29-99)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

T-31636

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

TE 09/623554

INTERNATIONAL APPLICATION NO.

PCT/DK99/00102

INTERNATIONAL FILING DATE

March 3, 1999

PRIORITY DATE CLAIMED

March 3, 1998

**TITLE OF INVENTION: A METHOD IN THE COMPENSATION OF UNLINEARITIES IN AN
AMPLIFIER, AND USES OF THE METHOD AND THE AMPLIFIER**

APPLICANT(S) FOR DO/EO/US

ANDERSKOUV, Niels; RISBO, Lars; and MORCH, Thomas

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☒ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
International Publication No. WO 99/45641;
Form PCT/RO/101;
Form PCT/IB/304;
Form PCT/IB/306;
Form PCT/IB/308;
Form PCT/IB/332;
Form PCT/IPEA/409;
Form PCT/IPEA/416;

ATTORNEY'S DOCKET NUMBER
T-31636

IN THE UNITED STATES DESIGNATED ELECTED OFFICE

In re the Application of:

Docket No.: T-31636

Anderskouv, et al

U.S. Serial No.: TBD

PCT Application No.: PCT/DK99/00102

Art Unit: TBD

Filed: 5 September, 2000

Examiner: Not Assigned

Title: A METHOD IN THE COMPENSATION OF UNLINEARITIES IN AN AMPLIFIER, AN
AMPLIFIER, AND USES OF THE METHOD AND THE AMPLIFIER

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Box PCT Applications
Washington, D. C. 20231

"EXPRESS MAIL" mailing label number
EL552916025US, Date of Deposit: : 5 September,
2000. I hereby certify that the Preliminary Amendment and the
accompanying Application is being deposited with the United States
Postal Service "Express Mail Post Office to Addressee" service
under 37 CFR 1.10 on the above-mentioned date and is addressed
to the Assistant Commissioner of Patents, Box PCT Applications,
Washington, DC 20231.


Allen B. Kroger

Sir:

Prior to the calculation of the filing fee for the above-identified application, please the
amend the application as follows.

IN THE CLAIMS:

Please amend Claims 1-12 as follows:

Claim 1 line 3 (page line no. 6) delete "consists" and substitute therefor --comprising--;
line 9 (page line no. 12) delete "characterized in that";

Claim 2 lines 1-2 (page line nos. 22-23) delete "characterized in that" and substitute
therefor --wherein--;

Claim 3 lines 1-2 (page line nos. 26-27) delete "characterized in that" and substitute
therefor --wherein--;

Claim 4 lines 1-2 (page line nos. 35-1) delete "1-3 characterized in that" and substitute therefor --1 wherein--;

Claim 5 lines 1-2 (page line nos. 4-5) delete "characterized in that" and substitute therefor --wherein--;

Claim 6 lines 1-2 (page line nos. 8-9) delete "characterized in that" and substitute therefor --wherein--;

Claim 7 lines 10-11 (page line nos. 21-22) delete "characterized in that";

Claim 8 lines 1-2 (page line nos. 31-32) delete "characterized in that" and substitute therefor --wherein--;

Claim 9 lines 1-2 (page line nos. 1-2) delete "or 8 characterized in that" and substitute therefor --wherein--;

Claim 10 lines 1-2 (page line nos. 7-8) delete "-9 characterized in that" and substitute therefor --wherein--;

11. (Amended) [Use of a] A method

[and an amplifier] according to [claims 1-10] claim 1 wherein said compensation is in a negative feedback system.

12. (Amended) [Use of a] A method

[and an amplifier] according to [claims 1-10] for the power control of resistive and reactive loads.

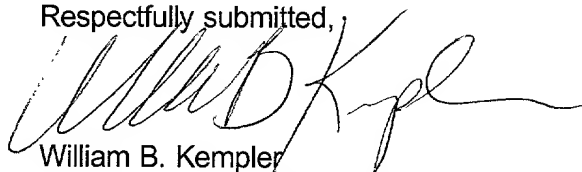
REMARKS

Entry and favorable action of the claims are earnestly solicited in light of the above amendments.

Applicants have amended the claims in order to avoid multiple claims and to place the claims in the appropriate form.

Early action on the merits is respectfully requested.

Respectfully submitted,



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533 Rec'd PCT/PTO 05 SEP 2000

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A method in the compensation of nonlinearities in an amplifier, an amplifier, and uses of the method and the amplifier

5

The invention relates to a method in the compensation of nonlinearities in an amplifier consisting of a pulse-width modulator wherein a signal is pulse-width modulated to provide a pulse-width modulated small-signal, and wherein
10 the pulse-width modulator has an output controlling a set of change-over switches which feed a load with a pulse-width modulated great-signal by means of a voltage supply.

15 The invention moreover relates to an amplifier of the type comprising a pulse-width modulator adapted to pulse-width modulate a signal to provide a pulse-width modulated small-signal, said pulse-width modulated signal being fed to at least two change-over switches adapted to
20 connect and disconnect a voltage supply to form a pulse-width modulated great-signal, and having means to compensate for error signals which occur in the signal paths between the pulse-width modulated great-signal and the pulse-width modulated small-signal.

25

Finally, the invention relates to uses of the amplifier.

Traditional amplifiers for audio uses are used for amplifying audio signals and for forming sound images in loud-
30 speakers. These amplifiers, however, do not have very high efficiencies.

Therefore, amplifiers are being designed according to other principles. These high efficiency amplifiers
35 include those which are based on pulse-width modulation.

These amplifiers are also referred to as class D amplifiers.

Such an amplifier consists of a pulse-width modulator, a set of change-over switches and a low-pass filter.

5

The principle of a class D amplifier is that two change-over switches are switched to conduct and non-conduct, respectively, depending on the amplitude of a signal, such as an audio signal. The information of the audio
10 signal is hereby converted into a series of pulses whose width corresponds closely to the information of the audio signal.

Instead of two change-over switches, it is possible to
15 use four change-over switches which are caused to conduct and non-conduct in pairs.

Pulse-width modulated amplifiers are theoretically very linear and thereby have a very low distortion, but practical
20 realizations have shown that nonlinearities are unfortunately formed in these amplifiers, which has prohibited the use of these as High Fidelity amplifiers unless strong negative feedback systems have been established.

25 However, establishment of feedback systems in pulse-width modulated amplifiers is not an easy task, since negative feedback performed prior to the low-pass filtering causes much noise in the system.

30 Furthermore, the load impedance, which is a loudspeaker, is incorporated in the design of the feedback system, and since this impedance may vary depending on loudspeaker selection, the design is thus impeded by the feedback system.

35

A great part, but not an exclusive part, of the unlinearities in pulse-width modulated amplifiers occurs because the voltage supply to the change-over switches is not constant in the operation of the amplifier.

5 The reason is that the gain in pulse-width modulated amplifiers is derived from the supply voltage to the change-over switches incorporated in the amplifier, divided by the peak voltage of the carrier wave, which is typically a saw-toothed or triangular signal. The gain of
10 the amplifier is thus proportional to the supply voltage, so that variations in it cause a so-called multiplicative error to occur on the output signal from the change-over switches.

15 A regulated voltage supply may be used to eliminate unlinearities, but a very complex power supply circuit is required for sufficiently linear properties to be achieved, which adds considerably to the costs of the amplifier.

20

Moreover, it is known that the dead time, which is the time where none of the change-over switches is made, causes distortion of the amplified signal.

25 It is therefore desirable to reduce the dead time to a minimum in pulse-width modulated power amplifiers. Conversely, less dead time causes problems of increased power consumption and strong ringing on the output signal, because both change-over switches carry current from
30 the supply directly down into earth.

The known methods of linearizing pulse-width modulated amplifiers require strong negative feedback, as mentioned. These methods are particularly unuseful for consumer amplifiers, where design criteria such as low com-
35

plexity and general usefulness in a broad range of load are important.

Finally, O 503 571 A1 discloses a class D amplifier in
5 which variations in the voltage supply are compensated by

changing the carrier wave signal as a function of an error in the voltage supply.

10 On the other hand, other errors that may cause errors in the pulse widths of the pulse-width modulated great-signal will not be included in the compensation.

Accordingly, an object of the invention is to provide a
15 method which is capable of linearizing and compensating for all errors which occur between the signal paths of a pulse-width modulated small-signal and a pulse-width modulated great-signal.

20 The object of the invention is achieved by the method defined in the introductory portion of claim 1 which is characterized in that the inevitable error, which manifests itself in that the pulse widths of the pulse-width modulated great-signal differ from the pulse widths of
25 the pulse-width modulated small-signal, is detected as an error signal which is used for changing the pulse-width modulation, said pulse-width modulated small-signal being varied in a manner which corresponds to the detected error signal.

30

When, as stated in claim 2, the error signal is detected as a multiplicative error signal, it is relatively easy to modulate the carrier wave signal as a function of the multiplicative error signal.

35

As stated in claim 3, the detected multiplicative error signal is determined as the pulse-width modulated small-signal multiplied by the pulse-width modulated great-signal and the inverted small-signal multiplied by the inverted pulse-width modulated great-signal.

A further circuit-technical advantage is achieved hereby as the compensating circuit both compensates for the multiplicative errors in the pulse width and additionally for the pulse height that occurs in the change-over switches. In addition, a simple implementation of the invention is achieved.

It is noted that the method is particularly suitable for compensating for multiplicative errors in an H-bridge which is operated in class AD operation.

Expediently, as stated in claim 4, the pulse-width modulation is performed by means of a carrier wave signal, which is particularly expedient for use in the pulse-width modulation of analogue signals, when the carrier wave signal is analog.

It is however also possible to use a carrier wave signal that is digital.

For simple circuit design of the pulse-width modulation, it is an advantage if, as stated in claim 5, a saw-toothed or triangular carrier wave signal is used.

When, as stated in claim 6, the slew rate of the carrier wave is adjusted by an external signal, it is ensured that the gain of the compensated amplifier may be varied over a great range.

As mentioned, the invention also relates to an amplifier.

This amplifier is characterized in that the means for compensating for the error signals are formed by a detector adapted to detect deviations between the pulse widths of the great-signals and of the small-signals, and that
5 the output of the detector is connected to a controlled carrier wave generator.

An amplifier is hereby provided in which inevitable nonlinearities, which manifest themselves by differences between the pulse-width modulated small-signals and the
10 pulse-width modulated great-signals, may be eliminated without complicated feedback stages.

Expedient embodiments of the amplifier are defined in
15 claims 8-10.

Finally, the invention relates to uses of the method and the amplifier, as mentioned.

20 The use according to claim 11 allows a much simpler structure to be provided than the negative feedbacks traditionally used in pulse-width modulated amplifiers.

The use according to claim 12 allows the amplifier to be
25 used for the control of resistive and reactive loads, which are e.g. found in electric motors, physical laboratory equipment, measuring apparatus, etc.

The invention will now be explained more fully with reference to an embodiment of the invention shown in the
30 drawing, in which

fig. 1 shows the basic structure of the invention in a block diagram form,

35

fig. 2 shows an example of a carrier wave signal,

fig. 3 shows an example of a signal which may be modulated by the signal of fig. 2,

5

fig. 4 shows the signal of fig. 3 pulse-width modulated,

fig. 5 shows an example of variations in the voltage supply of the amplifier as a function of the signal of fig. 3,

10

fig. 6 shows the modulation of the carrier wave signal of fig. 2,

figs. 7 and 7A show a triangular carrier wave signal whose characteristic is changed,

15

figs. 8 and 8A show a saw-toothed carrier wave signal whose characteristic may be changed,

20

fig. 9 shows a first example of a circuit array for use in the detection of multiplicative errors,

fig. 10 shows an example of the signal shapes in the first detecting circuit, and

25

fig. 11 shows an example of a second circuit for the detection of multiplicative errors in a half-bridge or a multiple thereof.

30

In fig. 1, the numeral 2 shows a signal which may be pulse-width modulated in a pulse-width modulator 4, e.g. with the shown carrier wave signal 3, where the carrier wave signal, in addition to the triangular shape shown, may be saw-toothed. The pulse-width modulation may pro-

35

vide the small-signal pulse-width modulated signal 5 shown which may control a set of change-over switches 6. A supply voltage 12 is applied to the change-over switches 6, whereby they provide a pulse-width modulated great-signal 7 having an amplitude which is given by the supply voltage 12 and the position of the change-over switches 6. The pulse-width modulated great-signal 7 is filtered through a low-pass filter 8, and the resulting signal is applied to a load, here shown as a loudspeaker 9.

Fig. 1 additionally shows a compensating circuit 30 which consists of a voltage sensor 10 and a controllable carrier wave modulator 11. It is noted that this carrier wave modulator could be implemented in an analog as well as digital version. The supply voltage 12 is detected by the voltage sensor 10 which provides a control signal for the carrier wave modulator 11. The carrier wave modulator 11 thus modulates the carrier wave signal 3 with the signal generated by the voltage sensor, so that the amplifier is compensated for the inevitable nonlinearities which are created by the varying supply voltage.

Fig. 2 shows an example of an uncompensated carrier wave signal which is capable e.g. of modulating the signal 2 shown in fig. 3 by means of the pulse-width modulator 4, so as to provide the pulse-width modulated signal shown in fig. 4.

If the change-over switches 6 are fed from an uncontrolled voltage supply, the supply voltage may assume a shape as shown at 12 in fig. 5. As will be seen, the supply voltage now consists of a DC value which is superposed by a rectified sine voltage. This supply voltage will give rise to serious nonlinearities in the amplifier,

which, of course, gives rise to strong nonlinearities in it. Compensation for these deviations must therefore be provided.

5 Fig. 6 shows an example of a compensated carrier wave signal 15. The peak value of this signal 15 varies as a function of the variation of the supply voltage, cf. fig. 5, to the change-over switches. The compensated carrier wave signal 15 shown in fig. 6 is characteristic by hav-
10 ing a constant frequency, but nothing prevents the compensation from being performed such that the derivative of the voltage of the carrier wave signal on the modulating flanks is numerically constant, thereby allowing the frequency of the carrier wave signal to be varied.

15 As will appear from figs. 7 and 7A, the carrier wave 3 may be compensated according to another principle where the carrier wave may basically be given e.g. by a carrier wave signal 29 which is frustoconical. The first deriva-
20 tive of the modulating flanks of this signal is seen to be numerically greater than the modulating flanks of the previously mentioned triangular signal. As a result, the amplifier has a lower gain, even though the peak-to-peak value is maintained. It will thus be seen that for a
25 maintained peak-to-peak value of the carrier wave signal the numerical value of the first derivative of the carrier wave signal may be varied so that the shape of the resulting carrier wave signal varies between the signal shapes shown at 16 and 17.

30 Figs. 8 and 8A show a second compensating principle for the carrier wave, e.g. as shown at 21. The first derivative of the modulating flank of this carrier wave signal is seen to be greater than the first derivative of the
35 saw-toothed carrier wave signal, which causes the ampli-

fier to have a lower gain, even though the peak-to-peak value of the carrier wave signal is maintained. It will be seen that for a maintained peak-to-peak value of the carrier wave signal the gain of the first derivative of the carrier wave signal may be varied so that the shape of the resulting carrier wave signal varies between the signal shapes given at 19 and 20.

Fig. 9 shows the basic structure of a circuit which, together with an H-bridge, can multiply the pulse-width modulated great-signal 7 with the pulse-width modulated small-signal 5. Compare fig. 1.

The circuit may be designed such that the pulse-width modulated small-signals, which control each of the half-bridges A and B, are connected to the control legs 39 and 40 of the switches, each of said switches being formed by two very fast switches which may be switched approximately as a set of ideal change-over switches.

The inputs 31 and 32 of the change-over switches are connected to the outputs 37 and 38, respectively, of the H-bridge, while the outputs 33 and 36 as well as 34 and 35 of the switches are connected in pairs. The resulting differential voltage between the terminals 41 and 42 is then given by the pulse-width modulated great-signal of the H-bridge multiplied by the pulse-width modulated small-signal 5.

The differential signal between the terminals 41 and 42 will be proportional to the supply voltage 12, when the pulse widths of the pulse-width modulated great-signal 7 of the H-bridge are identical with the pulse-width modulated small-signal 5, and it will be seen that the differential signal, if applied to the carrier wave modula-

tor, may compensate for variations in the supply voltage
12.

Furthermore, the differential signal between 41 and 42
5 will vary in proportion to the error (inevitable in practice) caused by a possible dead time, which means that the circuit in fig. 9, if it is connected to the carrier wave modulator 11, can also compensate for nonlinearities in the H-bridge which originate from the presence of dead
10 time.

Fig. 10 at the top shows an example of a triangular wave carrier signal 3 and a resulting small-signal 43 which may be generated approximately ideally with a high degree
15 of linearity. Moreover, shown below the small-signal 43 is the pulse-modulated great-signal 44 which occurs on some of the change-over switches (not shown). As will be seen, the pulse widths of the small-signal differ from the pulse widths of the great-signal, which is caused in-
20 ter alia by the previously mentioned dead time during the switching sequence. If the pulse-width modulated small-signal 43 is now multiplied with the pulse-width modulated great-signal 44, a pulse-width modulated differential signal 45 is provided, as shown at the bottom of
25 fig. 10. This signal has an amplitude which is proportional to the supply voltage to the change-over switches, and a duty cycle which is inversely proportional to the difference between the pulse widths of the pulse-width modulated small-signal and the pulse-width modulated
30 great-signal 44. By suitable processing of the differential signal 45, this signal is used as a control signal for the carrier wave modulator 11 in the same manner as the signal from the voltage sensor 10, cf. fig. 1. It is noted that the differential signal 45, if it is connected
35 to the carrier wave modulator 11, can correct the

amplifier for errors in pulse widths as well as errors in pulse heights of the pulse-width modulated great-signal.

Fig. 11 shows the basic structure of a circuit forming a
5 detector 10 which together with 2 MOSFETs are arranged in a half-bridge capable of multiplying the pulse-width modulated great-signal 7 with the pulse-width modulated small-signal 5, cf. fig. 1.

10 The circuit may be constructed by connecting the pulse-width modulated small-signal, which controls the half-bridge, to the control legs 46 of the switch, said switch 55 being formed by three very fast switches which may be
15 switched approximately as a set of ideal change-over switches.

The terminal 49 of the change-over switch is connected to the output 37 of the half-bridge, and the terminals 60 and 61 of the switch are connected to the zero conductor
20 and a pure DC voltage, respectively, which is proportional to the unloaded supply voltage for the change-over switches, while the terminals 51 and 50, 59 and 60 as well as 57 and 58 of the switch are connected in pairs. The switch 62 provides an approximately ideal pulse-width
25 modulated great-signal, and it thus exhibits properties which are identical with an ideal half-bridge. The resulting multiplicative error signals are therefore an exact indication of the error in the half-bridge alone. The resulting differential voltage between 53 and 54 is then
30 given by the pulse-width modulated great-signal 7 of the half-bridge multiplied by the pulse-width modulated small-signal 5, and the inverted pulse-width modulated small-signal multiplied by the approximately ideal inverted pulse-width modulated great-signal.

35

The differential signal between the terminals 54 and 53 will be proportional to the supply voltage 12 when the pulse widths of the half-bridge are identical with the pulse-width modulated small-signal 5, and it will be seen
5 from this that the differential signal, if applied to the carrier wave modulator, can compensate for variations in the supply voltage 12.

Additionally, the differential signal between 54 and 53
10 will vary proportionally to the multiplicative error which occurs in the change-over switches 23 and 24, which means that the circuit in fig. 11, if used as the detector 10 in fig. 1, can compensate for all multiplicative error signals in the half-bridge, originating inter alia
15 from the presence of dead time, conducting resistance and variations in the supply voltage 12 to the change-over switches.

As will be appreciated from the foregoing, the invention
20 provides an amplifier which is very universal and has a very low complexity.

The amplifier may be designed so that it may be used for many types of loads, without this interfering with the
25 specifications of the amplifier.

Furthermore, the amplifier may be produced with relatively small dimensions compared to traditional amplifiers because of the high efficiency, and thereby no
30 undesirably high heat emission.

The compensating circuit shown at 30 in fig. 1 may be realized with a very simple circuit design which just differs slightly from a traditional carrier wave generator.

P a t e n t C l a i m s :

1. A method in the compensation of nonlinearities in an
5 amplifier consisting of a pulse-width modulator (4),
wherein a signal is pulse-width modulated to provide a
pulse-width modulated small-signal (5), and wherein the
pulse-width modulator (4) has an output controlling a set
of change-over switches (6) which feed a load (9) with a
10 pulse-width modulated great-signal (7) by means of a
voltage supply (12), c h a r a c t e r i z e d in that
the inevitable error, which manifests itself in that the
pulse widths of the pulse-width modulated great-signal
(7) differ from the pulse widths of the pulse-width modu-
15 lated small-signal (5), is detected as an error signal
which is used for changing the pulse-width modulation,
said pulse-width modulated small-signal being varied in a
manner which corresponds to the detected error signal.
- 20 2. A method according to claim 1, c h a r a c t e r -
i z e d in that the error signal is detected as a multi-
plicative error signal.
3. A method according to claim 2, c h a r a c t e r -
25 i z e d in that the detected multiplicative error signal
is determined as the pulse-width modulated small-signal
multiplied by the pulse-width modulated great-signal and
the inverted small-signal multiplied by the inverted
pulse-width modulated great-signal.
- 30 4. A method according to claims 1-3, c h a r a c t e r -
i z e d in that the pulse-width modulation is performed
by means of a carrier wave signal.
- 35 5. A method according to claim 4, c h a r a c t e r -

i z e d in that a saw-toothed or triangular carrier wave signal is used.

6. A signal according to claim 5, c h a r a c t e r -
i z e d in that the slew rate of the carrier wave signal
5 is adjusted with an external signal.

7. An amplifier of the type comprising a pulse-width modulator (4) adapted to pulse-width modulate a signal to provide a pulse-width modulated small-signal (5), said
10 pulse-width modulated signal being fed to at least two change-over switches (6) adapted to connect and disconnect a voltage supply (12) to form a pulse-width modulated great-signal, and having means to compensate for error signals which occur in the signal paths between the
15 pulse-width modulated great-signal (7) and the pulse-width modulated small-signal (5), c h a r a c t e r -
i z e d in that the means for compensating for the error signals are formed by a detector (10) which is adapted to detect deviations between the pulse widths of the great-signals and of the small-signals, and that the output of
20 the detector (10) is connected to a controlled carrier wave generator (11).

8. An amplifier according to claim 7, c h a r a c -
25 t e r i z e d in that the detector (10) is adapted to multiply the pulse-width modulated small-signal with the pulse-width modulated great-signal and to multiply the inverted pulse-width modulated small-signal with the inverted pulse-width modulated great-signal.

30

9. An amplifier according to claim 7 or 8, c h a r a c -
t e r i z e d in that the controllable carrier wave generator (11) is adapted to keep the frequency of the carrier wave constant.

35

10. An amplifier according to claims 7-9, c h a r a c -
t e r i z e d in that the controllable carrier wave gen-
erator (11) is adapted to change the slew rate of the
carrier wave on the basis of the detected multiplicative
5 error signal.

11. Use of a method and an amplifier according to claims
1-10 in a negative feedback system.

10 12. Use of a method and an amplifier according to claims
1-10 for the power control of resistive and reactive
loads.

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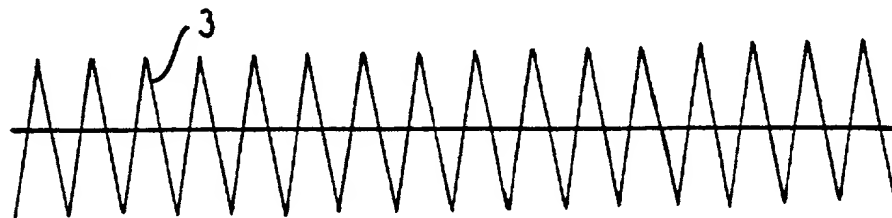
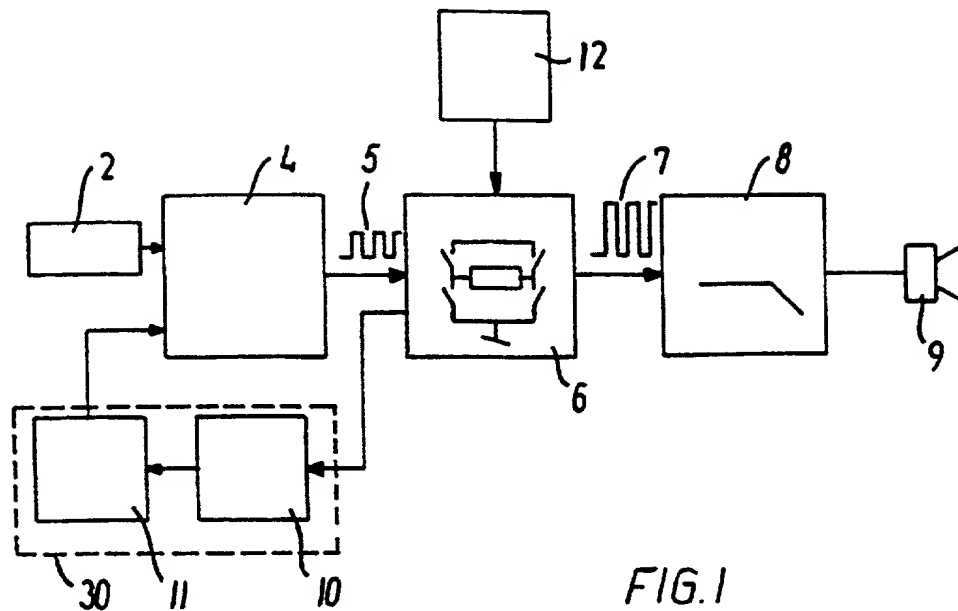


FIG. 2

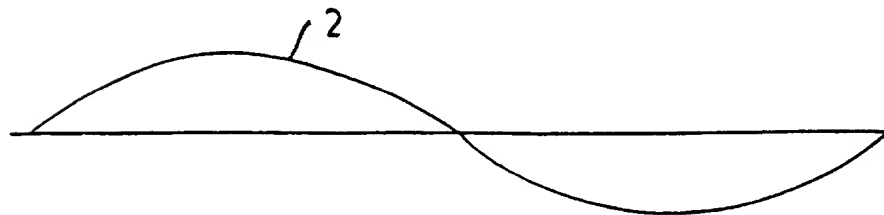


FIG. 3

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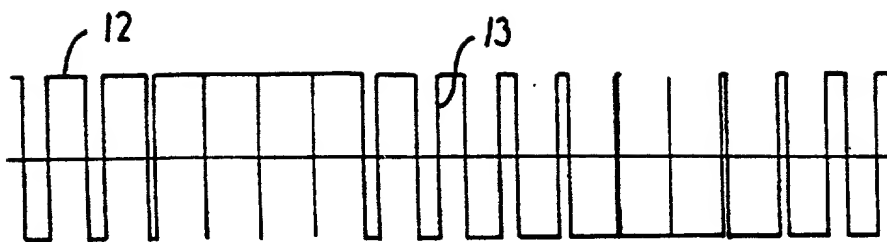


FIG. 4

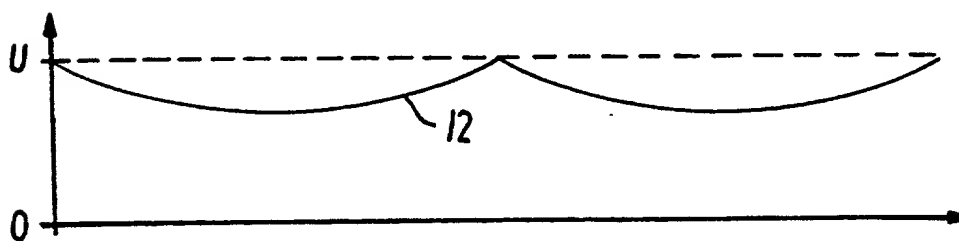


FIG. 5



FIG. 6

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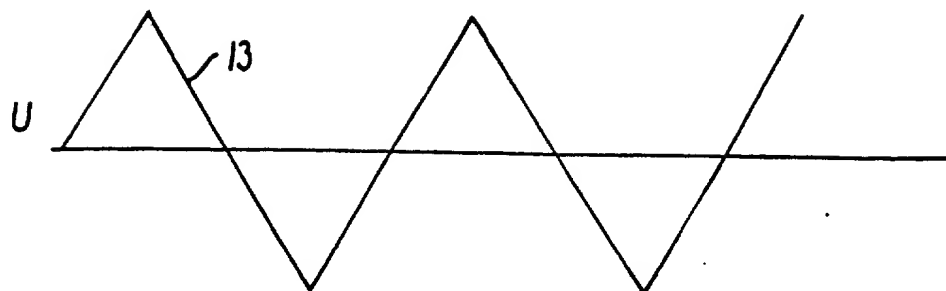


FIG. 7

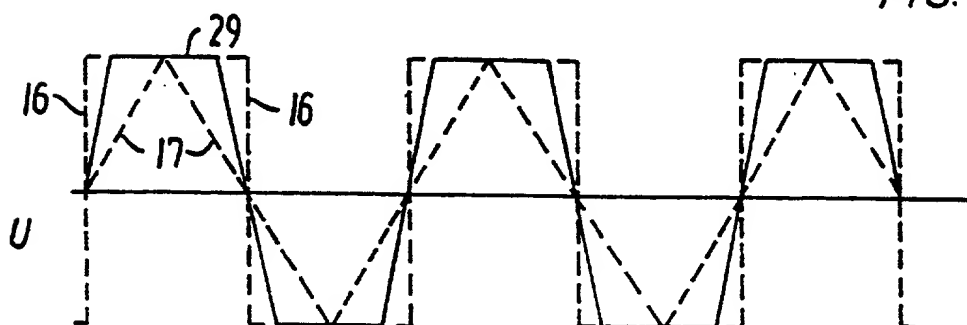


FIG. 7a

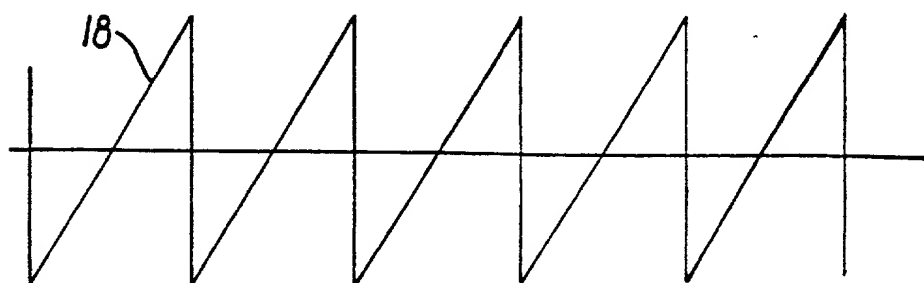


FIG. 8

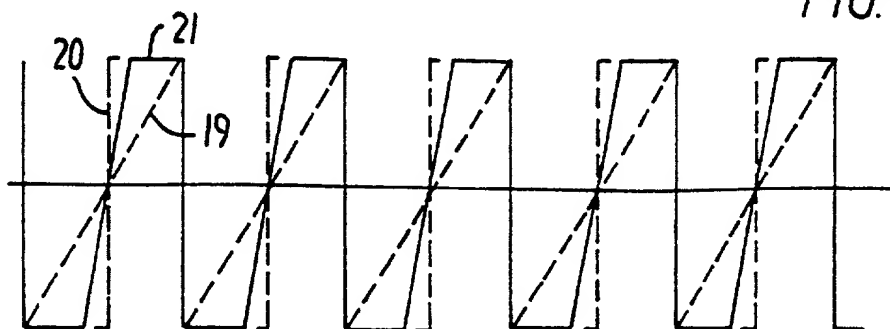


FIG. 8a

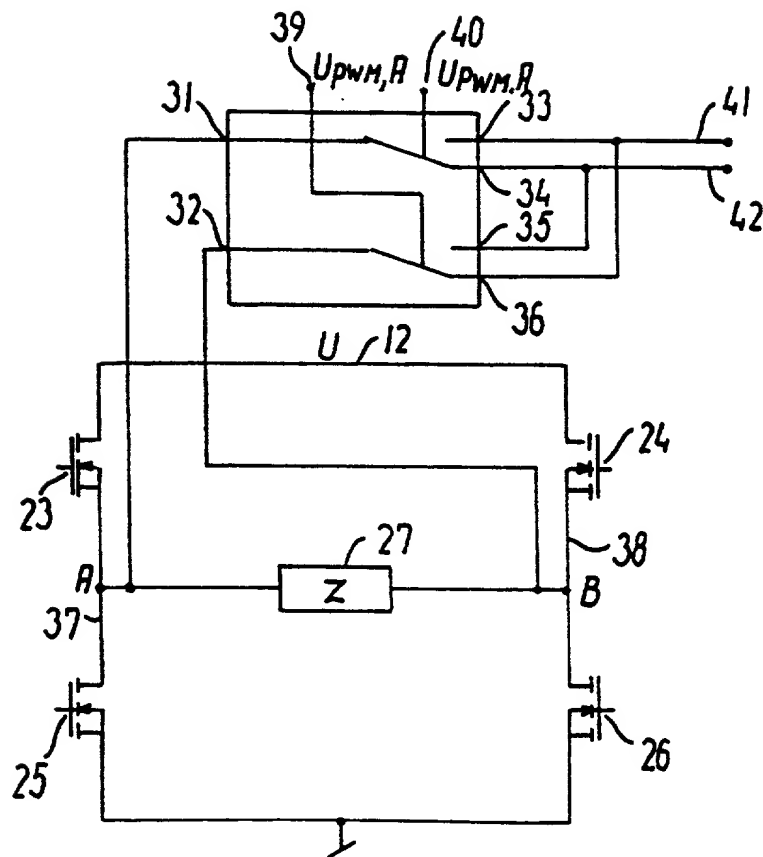


FIG. 9

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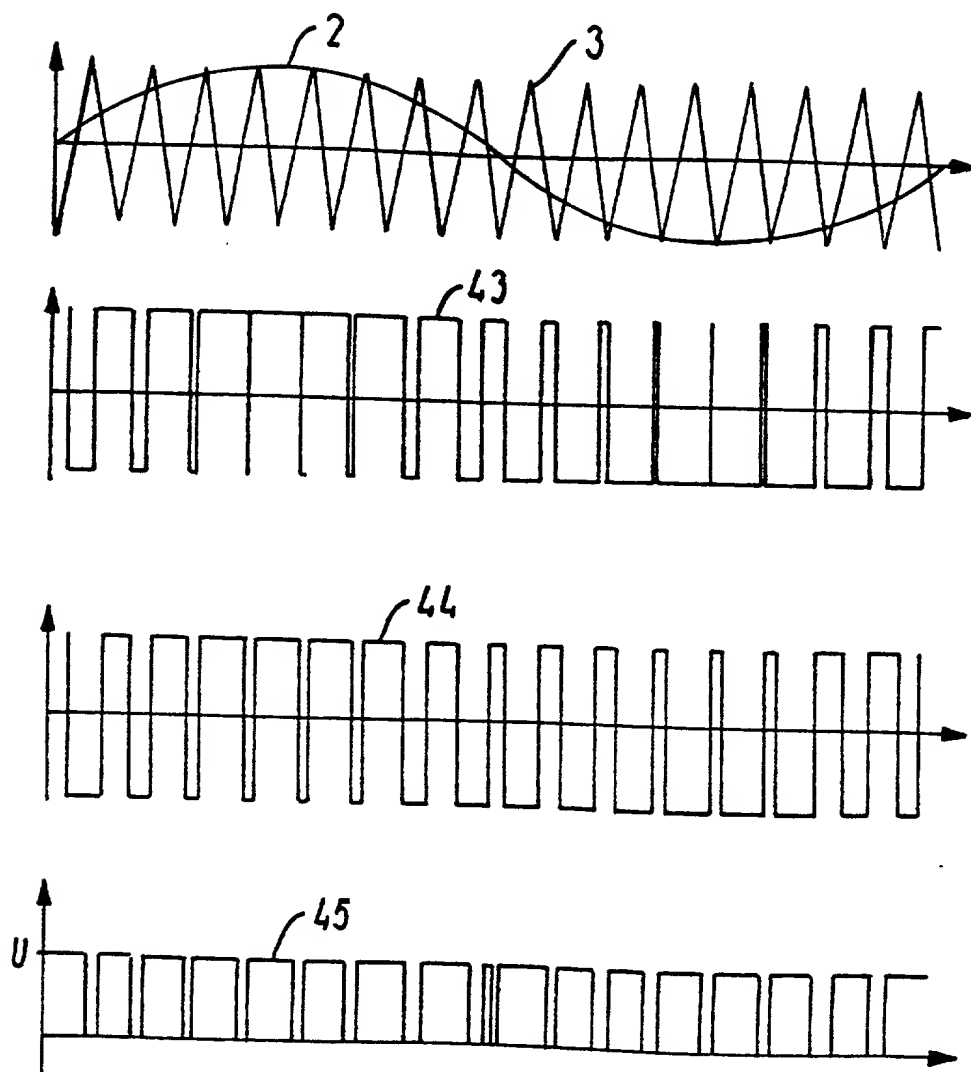


FIG. 10

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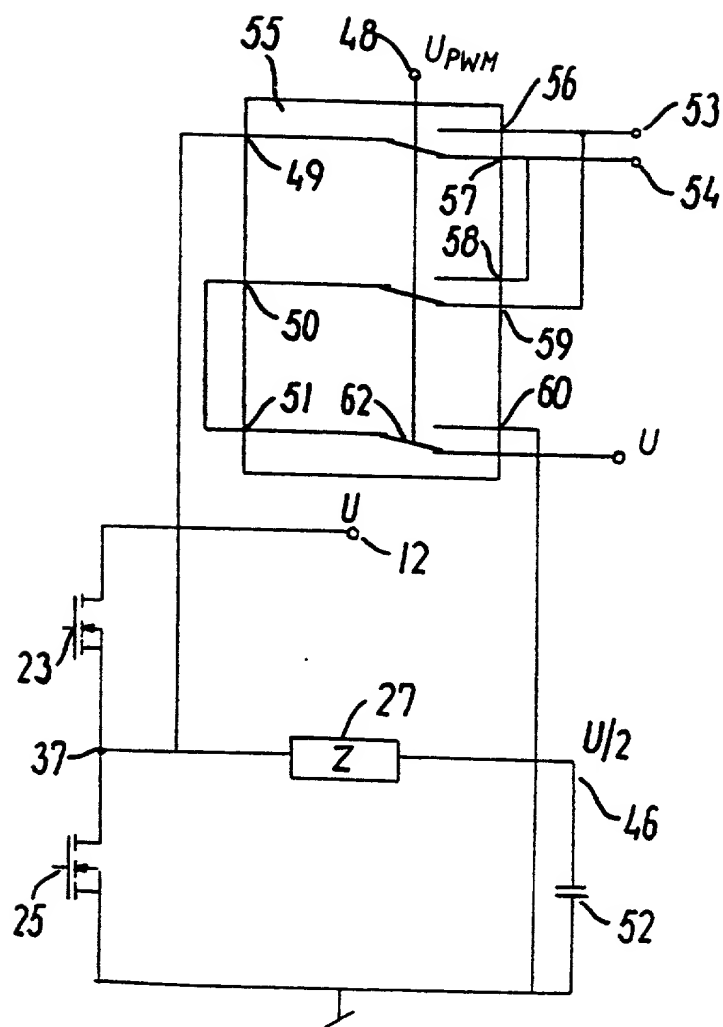


FIG. II

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**A METHOD IN THE COMPENSATION OF UNLINEARITIES IN AN AMPLIFIER,
AN AMPLIFIER, AND USES OF THE METHOD AND THE AMPLIFIER**

the specification of which (check only one item below):

☐ is attached hereto.

☒ was filed as United States application

Serial No. 09/623,554

on 09/05/2000

and was amended

on 09/05/2000 (if applicable).

☐ was filed as PCT international application

Number _____

on _____

and was amended under PCT Article 19

on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT, indicate PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
Denmark	0283/98	03/03/1998	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

TIDK-31636

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120

U S APPLICATIONS

STATUS (Check one)

U S APPLICATION NUMBER

U S FILING DATE

PATENTED

PENDING

ABANDONED

PCT APPLICATIONS DESIGNATING THE U S

PCT APPLICATION NO.

PCT FILING DATE

U S SERIAL NUMBERS
ASSIGNED (if any)

PCT/DK99/00102

03/03/1999

X

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark office connected therewith.

Frederick J. Telecky, Jr., Reg. No. 29,979
Jay M. Cantor, Reg. No. 19,906

William B. Kempler, Reg. No. 28,228
All attorneys and agents under customer number 23494

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Texas Instruments Incorporated
P. O. Box 655474, M/S 3999
Dallas, Texas 75251

Direct Telephone Calls to:
William B. Kempler
(972) 917-5452

201	FULL NAME OF INVENTOR	FAMILY NAME ANDERSKOUV	FIRST GIVEN NAME Niels	SECOND GIVEN NAME (nmi)
	RESIDENCE & CITIZENSHIP	CITY Dallas TX	STATE OR FOREIGN COUNTRY Texas	COUNTRY OF CITIZENSHIP Denmark
	POST OFFICE ADDRESS	POST OFFICE ADDRESS 7601 Churchill Way, apt. 1034	CITY Dallas	STATE & ZIP CODE / COUNTRY Texas 75251, USA
202	FULL NAME OF INVENTOR	FAMILY NAME RISBO	FIRST GIVEN NAME Lars	SECOND GIVEN NAME (nmi)
	RESIDENCE & CITIZENSHIP	CITY Copenhagen	STATE OR FOREIGN COUNTRY Denmark	COUNTRY OF CITIZENSHIP Denmark
	POST OFFICE ADDRESS	POST OFFICE ADDRESS Markmandsgade 14	CITY Copenhagen	STATE & ZIP CODE / COUNTRY Denmark
203	FULL NAME OF INVENTOR	FAMILY NAME MORCH	FIRST GIVEN NAME Thomas	SECOND GIVEN NAME (nmi)
	RESIDENCE & CITIZENSHIP	CITY Soborg	STATE OR FOREIGN COUNTRY Denmark	COUNTRY OF CITIZENSHIP Denmark
	POST OFFICE ADDRESS	POST OFFICE ADDRESS Toftekaersvej 133	CITY Soborg	STATE & ZIP CODE / COUNTRY Denmark 2860

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon

SIGNATURE OF INVENTOR 201

SIGNATURE OF INVENTOR 202

SIGNATURE OF INVENTOR 203

Niels ANDERSKOUV

Lars RISBO

Thomas MORCH

DATE

DATE

DATE

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
(Includes Reference to PCT International Applications)

ATTORNEYS DOCKET NUMBER
TIDK-31636

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

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☐ is attached hereto.

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COUNTRY (if PCT, indicate PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
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			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

Combined Declaration For Patent Application and Power of Attorney (Continued)				ATTORNEY'S DOCKET NUMBER TIDK-31636	
<p>I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:</p>					
PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120					
U S APPLICATIONS			STATUS (Check one)		
U S APPLICATION NUMBER	U S FILING DATE	PATENTED	PENDING	ABANDONED	
PCT APPLICATIONS DESIGNATING THE U S					
PCT APPLICATION NO	PCT FILING DATE	U S SERIAL NUMBERS ASSIGNED (if any)			
PCT/DK99/00102	03/03/1999			X	
<p>POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark office connected therewith.</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Frederick J. Telecky, Jr., Reg. No. 29,979 Jay M. Cantor, Reg. No. 19,906</p> </div> <div style="width: 45%;"> <p>William B. Kempler, Reg. No. 28,228 All attorneys and agents under customer number 23494</p> </div> </div>					
Send Correspondence to:		William B. Kempler Texas Instruments Incorporated P. O. Box 655474, M/S 3999 Dallas, Texas 75251		Direct Telephone Calls to: William B. Kempler (972) 917-5452	
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<p>I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon</p>					
SIGNATURE OF INVENTOR 201		SIGNATURE OF INVENTOR 202		SIGNATURE OF INVENTOR 203	
Niels ANDERSKOUV		Lars RISBO		Thomas MORCH	
DATE		DATE		DATE	
		2001-02-12		2001-02-12	